

TABLE 2.—Daily totals and departures of solar and sky radiation, at Washington, D. C., during March, 1915—Continued.

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily total.	Departure from normal.	Excess or deficiency since first of month.	Possible sunshine.	Average cloudiness.
	Gr.-cal.	Gr.-cal.	Gr.-cal.	Per cent.	0-10
19.....	200	-144	862	48	8
20.....	261	- 91	771	60	9
Decade departure.....			390		
21.....	486	132	903	98	2
22.....	371	15	918	82	6
23.....	285	- 73	845	52	7
24.....	234	-126	719	39	8
25.....	442	80	799	79	5
26.....	251	-113	686	55	6
27.....	497	131	817	90	5
28.....	522	154	971	100	1
29.....	552	182	1,153	100	1
30.....	543	171	1,324	83	5
31.....	564	190	1,514	100	0
Decade departure.....			733		
Total excess or deficiency since first of year.....			-241		

In Table 2, column 2 gives the daily totals of solar and sky radiation received on a horizontal surface. The measurements were made with a Callendar recording

pyrheliometer as described in this REVIEW p. 100. Column 3 gives the departures from the daily normals given in this REVIEW, p. 106, Table 4.

The above data show less than the average cloudiness, more than average sunshine, and solar radiation above the average in intensity during March, 1915.

THERMO-ISOPLETHS FOR WASHINGTON, D. C.

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[Dated: Washington, D. C., May 1, 1915.]

On another page Prof. H. H. Kimball presents a diagram of isopleths of the combined solar and sky radiation received at Washington, D. C., throughout the year. It is of much interest to compare with such a fundamental element the resultant surface air temperatures at the same locality; and by using a similar graphic method the comparison of cause and effect is facilitated. It is important to bear in mind that the scale of hours is not the same in the two diagrams. Insolation is a function of the sun's altitude and is always referred to solar altitudes in the primary work. Hence apparent time is used in diagrams of radiation isopleths while 75th meridian time serves for the thermo-isopleths presented herewith. The

TABLE 1.—Average hourly temperatures (°F.) by months at Washington, D. C., for the period 1890-1910.

[Seventy-fifth meridian time.]

Month.	A. M.												P. M.											Mid-night.	Mean.
	1	2	3	4	5	6	7	8	9	10	11	Noon.	1	2	3	4	5	6	7	8	9	10	11		
January.....	31.8	31.3	30.8	30.5	30.2	29.9	29.6	29.9	31.0	32.9	34.8	36.4	37.6	38.8	39.3	39.3	38.5	37.3	36.0	35.0	34.1	33.5	32.8	32.3	33.9
February.....	31.4	30.8	30.4	30.1	29.6	29.4	29.2	29.8	31.1	33.0	35.1	36.9	38.2	39.3	40.0	40.1	39.3	38.1	36.6	35.6	34.5	33.7	33.0	32.4	34.1
March.....	40.3	39.7	39.1	38.4	37.9	37.6	37.4	38.9	40.9	42.9	45.0	46.8	48.4	49.6	50.2	50.3	49.8	48.7	46.9	45.5	44.0	42.9	42.0	41.2	43.5
April.....	48.9	48.0	47.2	46.5	45.8	45.4	46.6	49.3	51.7	54.1	56.2	58.0	59.5	60.7	61.2	61.5	61.0	59.8	58.0	56.2	54.2	52.7	51.5	50.4	53.5
May.....	58.5	57.7	56.9	56.2	55.5	55.8	57.7	60.5	62.9	65.1	67.3	68.9	70.2	71.3	71.7	71.7	71.1	70.0	67.8	65.5	63.3	61.9	60.6	59.6	63.6
June.....	66.3	65.6	64.8	64.2	63.6	64.3	66.4	69.2	71.5	73.7	75.6	77.1	78.3	79.2	79.5	79.4	78.7	77.6	75.6	73.3	71.1	69.7	68.4	67.6	71.7
July.....	70.7	70.1	69.4	68.8	68.1	68.4	70.5	73.3	75.9	78.1	80.1	81.6	82.8	83.5	83.6	83.4	82.3	81.1	79.0	76.7	74.7	73.5	72.4	71.5	75.8
August.....	69.3	68.8	68.1	67.6	66.9	66.8	68.4	71.2	73.8	76.1	78.1	79.6	80.8	81.7	81.9	81.6	80.9	79.6	77.0	74.9	73.0	71.3	70.8	70.0	74.1
September.....	63.4	62.8	62.2	61.6	61.1	60.7	61.5	64.6	67.7	70.4	72.8	74.5	75.8	76.7	77.1	76.8	75.8	73.8	70.8	68.6	66.8	65.6	64.7	63.8	68.3
October.....	51.4	50.8	50.2	49.8	49.4	49.0	49.2	51.6	54.6	57.5	60.0	61.9	63.4	64.4	64.8	64.5	63.2	60.6	57.8	54.1	51.6	50.6	51.8	56.0	
November.....	42.0	41.5	41.0	40.5	40.2	39.9	39.7	40.8	43.1	45.8	48.2	50.0	51.5	52.4	52.8	52.2	50.8	48.0	44.3	40.0	36.0	34.0	33.0	35.4	
December.....	33.1	32.7	32.3	31.9	31.5	31.2	31.1	31.6	33.0	35.1	37.2	39.0	40.3	41.4	41.8	41.5	40.4	38.9	37.5	36.5	35.4	34.7	34.0	33.5	35.7

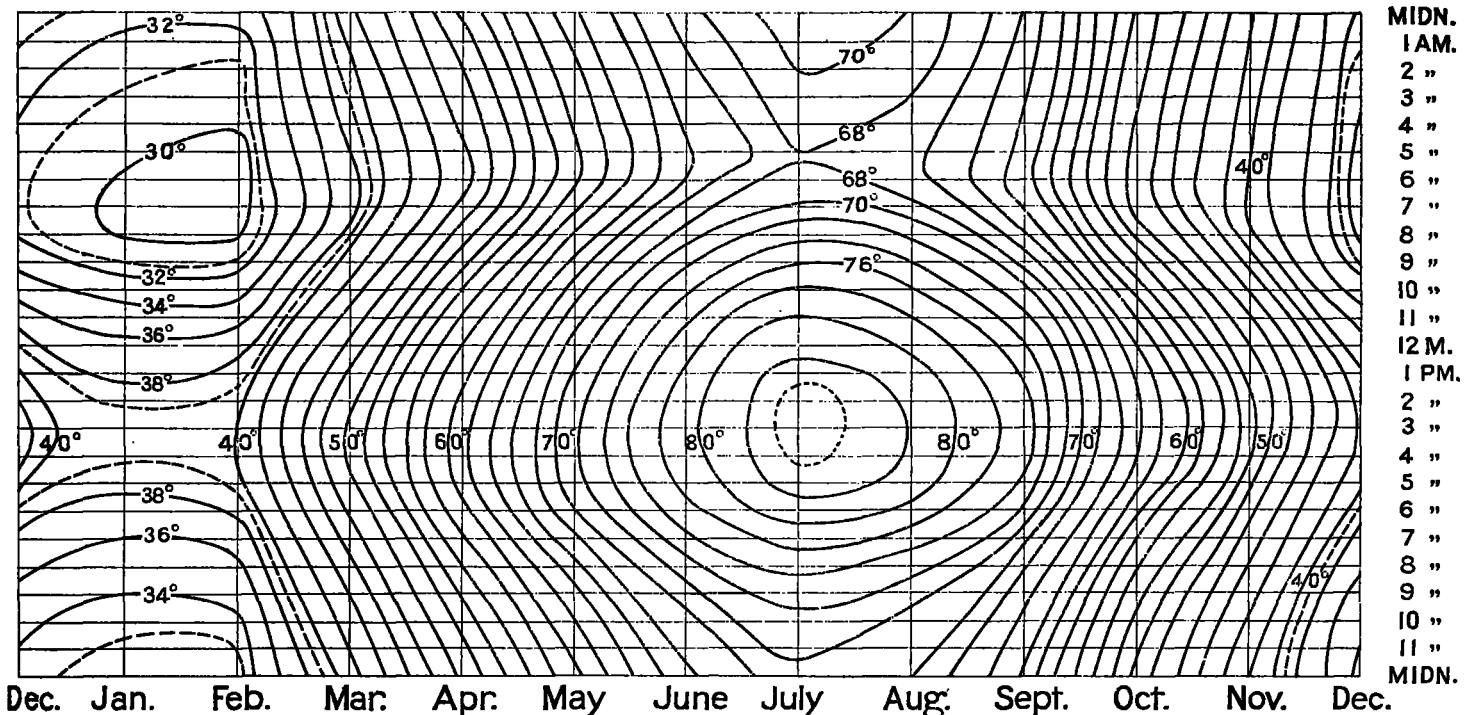


FIG. 1.—Thermo-isopleths for Washington, D. C., for the period 1890-1910. (°F.; 75th meridian time.)

difference in time may be found from column 3 of Kimball's Table 1 (p. 104).

The average hourly temperatures by months, which appear in Table 1, are the basis of the diagram of isopleths forming figure 1. They are for the interval 1890-1910, during which time the instrument (Richard thermograph) has been continuously under the same exposure in the present roof shelter at the corner of Twenty-fourth and M Streets NW. The averages were computed by Mr. Samuel A. Potter, of the Weather Bureau instrument division, who has carefully freed them from all known or suspected errors. They are here employed by his generous permission. The writer plotted them on the network used for figure 1 and drew the resulting thermo-isopleths for publication in the *New International Encyclopedia*. Figure 1 is here reproduced, with corrections, by permission of the managers of that publication.

Such diagrams of isopleths have been prepared, usually based upon much longer records, for many points in Europe and other continents; but not many have been presented for localities in the United States. Fassig¹ has prepared such for several elements of the climate of Baltimore; Cox and Armington² prepared isopleths for

Chicago, and Henry A. Hazen³ prepared them for several elements in earlier years at that same point. When an element is plotted in this manner for several differently exposed localities a comparison of the different diagrams readily reveals fundamental and sometimes unexpected contrasts. Thus, in figure 1 the varying spacing of the isopleths within the zone between noon and 5 p. m. throughout the year is characteristic for a situation similar to that of Washington. A point lying nearer the sea and to windward thereof reveals its location at once by a quite different spacing along this zone throughout the year.

Other portions of two such diagrams may be similarly compared; or advantage may be taken of the simultaneous presentation of both hours and months throughout the year to compare the diagrams as great wholes which present at a brief glance the thermal character of the whole year. Professor Kimball has already (p. 102) indicated the interesting points which develop upon comparing his radiation isopleths with these thermo-isopleths. The future may offer an opportunity to draw comparisons between such diagrams for different localities in this country.

¹ Fassig, O. L. *The climate and weather of Baltimore, Md.* Baltimore, 1907. pp. 36, 62, 74, 80, 101, etc.

² Cox & Armington. *The weather and climate of Chicago, Ill.* Chicago, 1914. pp. 135, 205, 207, 214, 263, etc.

³ Hazen, Henry A. *The climate of Chicago, Ill.* Washington, 1893. (Weather Bureau bull. 10), pp. 52, 53, 54, 55, 66, etc.